Alternative Materials Recycling in the City of Bexley, Ohio

EEDS Capstone's collaboration with the City of Bexley and The Ohio State University ENR/AEDE 4567

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EEDS CAPSTONE
Alternative Materials Drop-Off

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1.0 Executive Summary

The School of Environment and Natural Resources at The Ohio State University collaborates with local communities, businesses, and organizations to develop proposals for students taking AEDE 4567 (Capstone). At the beginning of the semester, students selected intriguing topics and were grouped together in teams based on mutual interest. These projects allow students to collaborate and research while gaining valuable experience in a specific field or industry. A team of five Ohio State EEDS (Environment, Economy, Development, and Sustainability) students, named EEDS Capstone, partnered with the City of Bexley to research the demand for alternative materials recycling, providing recommendations based on those results. The City of Bexley is committed to a more sustainable future shown through Green Bexley. This is a project of the Environmental Sustainability Advisory Committee (ESAC), which is, "an innovative group dedicated to implementing the City's Zero Waste Plan and improving Bexley's sustainability practices... the ESAC assists the City in accomplishing its "Zero Waste objective by 2040 or sooner when it achieves a 90% reduction of materials disposed of at the landfill" (City of Bexley Zero Waste Plan). ESAC charged EEDS Capstone with the task of finding sustainable ways to recycle the city's alternative materials. We define alternative materials in a couple ways, the first as any common material that cannot be recycled through local existing recycling infrastructure (i.e. No.5 plastics, paint cans, newspapers) as well as "hard-to-recycle" material (i.e. hazardous materials, batteries, extruded polystyrene foam). We express throughout this report that most materials can be recycled or reused as long as the proper infrastructure exists. The main goal of this project is to divert waste away from landfills. The City of Bexley is not only committed to recycling alternative materials but recycling them in a sustainable way. In order to achieve the goal of a comprehensive sustainable alternative materials recycling program, EEDS Capstone conducted community

surveys and compiled data for future end-markets. Overall, we hope that this report provides guidance to the City of Bexley as they move to a more sustainable future.

2.0 Introduction

Bexley, OH is a town of 16,000 located on the east side of downtown Columbus and was incorporated in 1908. In past several years, Bexley has prioritized several green initiatives to make the city more sustainable, including providing curbside residential recycling and compost, reducing plastic usage, and other education and engagement programs. Bexley's Environmental Sustainability Advisory Committee (ESAC) has set their sights on making Bexley the first city in Ohio to comprehensively recycle all categories of materials that can be recycled, which has proven problematic because of the difficulty of finding end markets and establishing collection systems for such materials.

As student consultants for The City of Bexley, EEDS Capstone sought out possible remedies for the city's alternative materials recycling problems. Therefore, EEDS Capstone, Green Bexley (program of ESAC), and the City of Bexley collaborated to create an alternative materials recycling project. The city struggles to find feasible and effective end-markets for materials like clothing, No. 5 plastics, extruded polystyrene foam (Styrofoam), batteries, paint cans, and 'clamshell' plastics. The goal of this project was to provide data that was acquired from local residents, businesses, benchmark case studies, and community programs to measure the recycling demand regarding alternative materials. In advising the development of an alternative materials recycling drop-of center, our research also examined potential supply streams for the materials to feed into after collection at the drop-off location. Current local recycling and drop-off programs were evaluated in order to understand recycling infrastructure within and near Columbus, Ohio.

When solving an environmental issue like recycling it is important to look at each step through the lens of sustainability. Our recommendations are designed to address sustainability goals presented by Green Bexley such as education, engagement, advocacy, and advisory.

These goals served as guiding principles to shape our research goals and objectives. Our research methods include case studies, baseline study of current programs, surveys, and community outreach. The results of our analyses are integrated into our recommendations for the city including our suggestions for a comprehensive sustainable alternative materials recycling program, a partnership with Terracycle, and a mobile application. Along with a drop-off site, educating the public about how and where they can reuse, recycle, and dispose of their alternative materials through a mobile application will allow residents to self-educate and lessen the burden on the city. We think our suggestions to the city can help improve Bexley's current recycling infrastructure.

3.0 Methods

In order to obtain appropriate data, our primary method of research was a survey distributed among Bexley residents. Other methods of data collection included discussion with the Chair of Green Bexley, Elizabeth Ellman and attending a local ESAC meeting where we were able to gain an understanding of current recycling needs. The ESAC meeting and survey results helped to identify what alternative materials should be prioritized and the preferred placement of Terracycle boxes. Lastly, we researched case studies that outlined similar programs that have been deployed in other places. These case studies provided a framework upon which we based our recommendations.

4.0 Objectives:

4.1 Case Studies

Case studies were conducted in order to better understand alternative materials recycling programs that were successful in communities similar to Bexley. Through online research, emails, and phone calls we were able to learn more about programs such as; the "Beyond the Bin" program at St. Anthony's Parish in Cincinnati, Ohio, another program of the same name in Oklahoma City, and Preserve's "Gimme 5" program, a partnership with Whole Foods. There are several "Beyond the Bin" programs that collect and recycle alternative materials. The St. Anthony's Parish "Beyond the Bin" program was started in 2014 as a way for the community to recycle pill bottles, batteries, electronics, corks, pop tabs, toothpaste tubes, and several other items (Abercrombie, 2015). The City of Oklahoma "Beyond the Bin" program offers "a handy list of places to take certain items, such as automotive items, batteries, electronics and more" (Beyond the Bin, Oklahoma City). Preserve's "Gimme 5" program started in 2007 as a partnership with Whole Foods. The goal of this program is to "help consumers 'close the loop' in their products' lifespans" (Preserve, 2020). They collect and recycle No. 5 polypropylene plastics. "Gimme 5" is a relevant initiative because there is a Whole Foods located within the City of Bexley. Each program offers a unique look into the way other cities have gone about recycling hard-to-recycle materials.

4.2 Existing Infrastructure

The purpose of this objective was to retrieve data on local recycling infrastructure. By surveying Rumpke, SWACO, Kroger, and Ohio Drop-off, as well as several smaller independent recycling companies (OEW Recycling, A-Z Recycling Inc., and Green Ohio Recycling) we were able to gain a better understanding of existing programs within the

Columbus area. By understanding existing recycling infrastructure, we were able to make more informed recommendations to the City of Bexley. Our research included combing through each of the programs' websites (reference the "Literature Cited" section) as well as contacting those companies via email and phone calls. Rumpke is the main provider of waste management services within the City of Columbus. They offer a "single stream" recycling program that allows residential recyclables to be mixed together. While this program has its benefits, it also has several drawbacks. Rumpke is only able to accept a handful of "non-contaminated" materials. Ohio Drop-Off, an alternative materials recycling facility, is conveniently located on the outskirts of Bexley, but they only recycle a limited list of alternative materials (i.e. computer equipment, washers, dryers, and stereo equipment). The initial request from the City of Bexley was to create a comprehensive alternative materials recycling system. We concluded that while there are existing recycling facilities in Ohio, they are not intuitive to the common user. They also require the city to collaborate and construct individual programs with each facility. This conclusion, along with local resident input helped to focus our research towards possible end markets and active programs that accept alternative materials for recycling.

4.3 Surveys

We quickly realized that in order to meet the needs of the community we had to narrow down the list of alternative materials for which we would explore end-markets. Our third objective was to develop and distribute surveys to Bexley residents and business owners in order to evaluate their recycling needs and concerns. With the help of the Green Bexley Chair and ESAC President Elizabeth Ellman, we were able to distribute these surveys via email newsletter and personal outreach. Overall, our survey received a total of 364 responses, giving

us crucial insight into the recycling demands of the community. A copy of the survey questions is included below:

1. Do you care about recycling?

    Yes
    No
    Indifferent

2. Do you recycle?

    Yes
    No
    Unable due to living situation (shared housing)

3. What are items that you find yourself not being able to recycle?

    Paint cans
    Number 5 plastics
    Styrofoam
    Batteries
    Clothing
    Other:

4. How often do you find yourself needing to dispose of materials listed previously?

    Once a week
    Once a month
    Once every six months

5. Would you be willing to take materials listed in question three to a local drop-off site?

    Yes
    No
    I do not recycle

An overwhelming majority of the residents who participated in the survey responded positively to our questions about recycling, with 98.4% of residents indicating they care about recycling and 99.2% of residents indicating that they currently recycle at home. *Figure 4.3.1 Survey Question #1, Figure 4.3.2 Survey Question #3,* and *Figure 4.3.3 Survey Question #5* relay a more detailed breakdown of the responses. The data from our survey results verified

that Bexley residents do care about recycling and are in need of disposal methods for items that are not conventional recyclables. We were able to narrow down a list of five materials that residents desire to recycle that lack existing recycling infrastructure: paint cans, batteries, clothing, Styrofoam, and No.5 plastics. From this list we were able to further research sustainable end markets for each material.

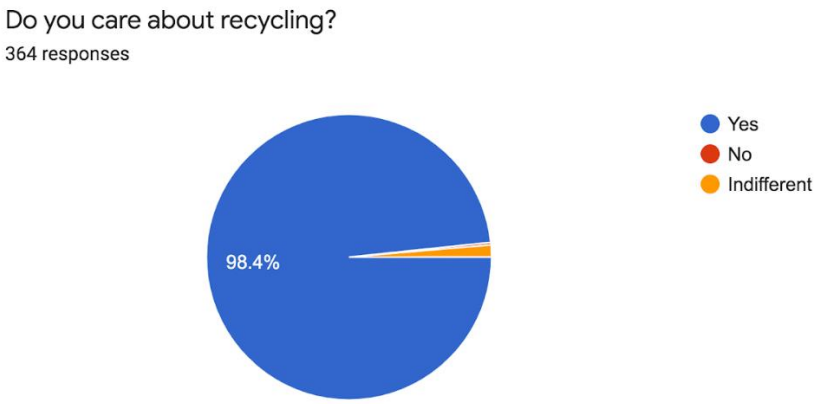

Figure 4.3.1 Survey Question #1 Results.

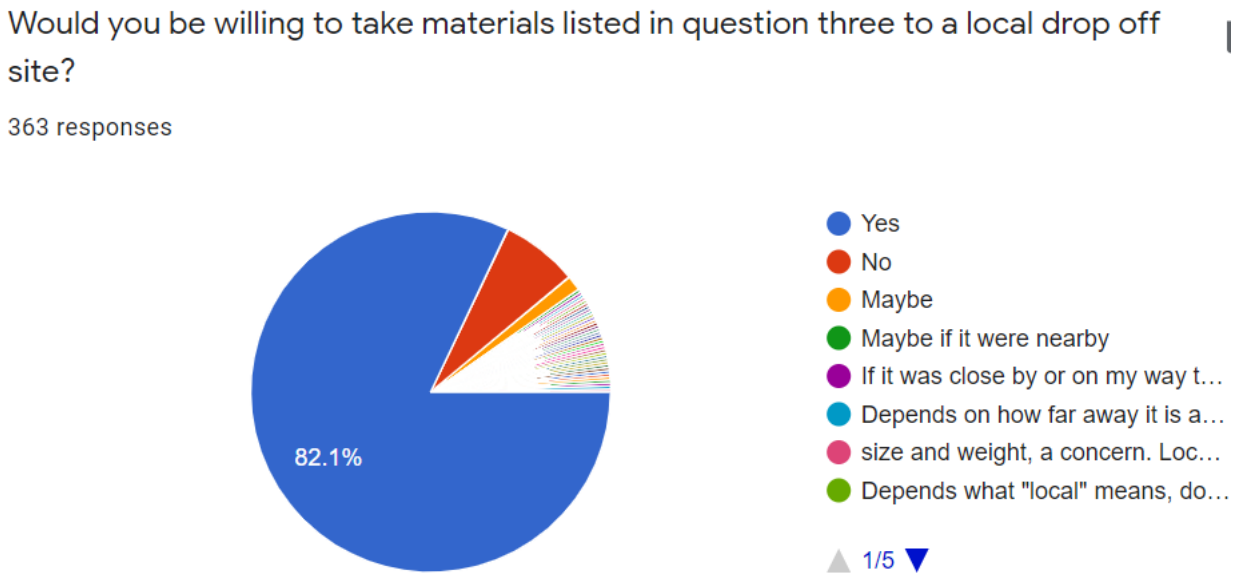

Figure 4.3.2 Survey Question #3 Results.

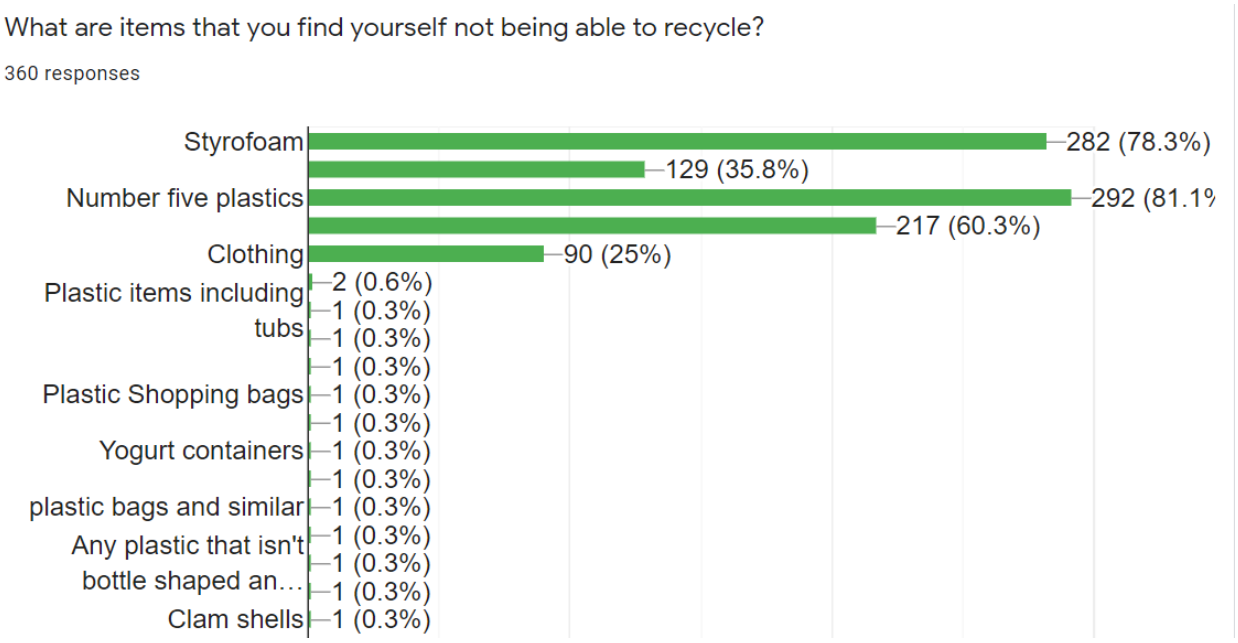

Figure 4.3.3 Survey Question #5 Results.

4.4: Alternative Material End Markets

Alternative materials are inherently hard to recycle and often lack sustainable end markets. The City of Bexley has stipulated several goals when it comes to recycling these materials. For the individual end markets to meet these goals, the entire transaction from initial acquisition to final repurposing must be sustainable. To meet these requirements, we had to find end markets that were near the City of Bexley in order to cut down on emissions from travel, while simultaneously finding ways to reuse the materials from our survey results. The five materials previously mentioned: paint cans, batteries, clothing, Styrofoam, and No.5 plastics cannot be recycled by Rumpke, the waste management service used within Bexley, and lack easy-to-recycle locations near residents.

- Paint Cans: The two different types of paints we researched were oil-based and latex-based. While attending an ESAC meeting we learned that both can be donated to local schools or theatre programs. Oil-based paint is a hazardous material and

therefore must be recycled through Rumpke's partner SWACO which safely disposes of waste. Paint stores will take used paint cans and process them through their facilities.

- Batteries: There are many different types of batteries. For the purpose of this project, we researched end markets for household and large electronic batteries. Household batteries include both lithium and alkaline AA, AAA, D-cell, button cell, and many others. There are several sustainable end markets to recycle batteries, including Batteries Plus Bulbs, a company with several local franchises that "is committed to recycling spent batteries and light bulbs as a means to reduce waste in our landfills, stop harmful chemicals from contaminating our soil and water, and preserve our environment by decreasing the need for new raw materials from the Earth" (Batteries Plus Bulbs, 2020). Batteries and Bulbs offers several ways to recycle including a mail-in program and drop-off locations at storefronts. The Big Green Box is another mail-in program where an empty box is shipped to the participant, who then fills the box with used batteries and ships them back to the company. The company then deconstructs, recycles, or reuses the batteries (The Big Green Box, 2020). There are some limitations to the Big Green Box, such as they do not accept automotive or damaged batteries.

- Clothing: For the purpose of this project we are specifically talking about tattered "not consignment" worthy clothing. Gently used clothing can be recycled at Bexley's local Goodwill. There are limited end markets for sustainable textile recycling. The first option is to send tattered textiles to local animal shelters where they can be used as rags or blankets for animals awaiting adoption. The second end

market is a company called Terracycle, a recycling program located in Trenton, New Jersey, that can potentially be used as an end market for all five alternative materials. Terracycle will be explained in greater detail in the recommendations section.

- Styrofoam: According to our research there are two extruded polystyrene foam recycling facilities that meet the sustainable recycling requirements laid out in this report. The first company is Terracycle (mentioned above), the second is a program called "Home for Foam." Located in Northeast Ohio and run by Buckeye Industries "Home For Foam is helping keep foam out of landfills while providing vocational training and employment to people living with disabilities through their free foam recycling program... individuals or businesses can drop-off their expanded polystyrene foam for free to any Buckeye location" (Home for Foam, n.d.). It is important to note that with all alternative materials, the first choice should be reduction in use. If companies and individuals would like to continue to use Styrofoam, there is an eco-friendlier product called Vio Foam. Vio Foam is a material that under the right landfill conditions will biodegrade 92% over 4 years, (lids biodegrade 86.8% over 7.9 years, straws biodegrade 88.5% over 7 years (Vio Foam, 2020)). In order for Vio Foam to be biodegradable, however, local landfills must be able to meet certain qualifications.

- No. 5 plastics: No. 5 plastics can be recycled through Preserve's "Gimme 5" program, a partnership with Whole Foods. "Gimme 5" also offers a mail-in option for individual homes. Whole Food's writer Paige Brady explains the process, "We'll

send the plastic to Preserve, who make recycled household products including toothbrushes, razors, tableware, and kitchen products. When they get it, the plastic is ground up and turned into clean plastic pellets. The pellets are then sent to Preserve's manufacturing facilities to be transformed into new Preserve products" (Brady, 2009). There are several private recycling facilities across Ohio that will take No.5 plastics, but we did not receive a response from most of these facilities.

4.5 Outreach and Education

The City of Bexley is a tight knit community where most residents participate in city-wide events. The goal of incorporating outreach and education into our project is to promote these new alternative recycling programs. Bexley holds several community events a year, a few of which are geared towards their new sustainability efforts. These events will be a way for residents to gain information on new recycling programs and to ask questions or provide more input. Events like Bexley's Earth Day (canceled this year [2020] due to Covid-19 outbreak) will be a great opportunity to engage local community members in these new projects. EEDS Capstone was able to attend an ESAC meeting with board members, residents, and the city's Mayor. At this meeting we received feedback on our proposed survey and listened to community input on what aspects of recycling they feel they do not currently have access to. While we were unable to participate in as many community outreach events as we were hoping due to COVID-19, we provide recommendations on how Bexley can continue and advance recycling outreach and education with their citizens in the next section of our report.

5.0 Recommendations

The initial request from the City of Bexley was to help develop a "physical curbside drop-off site" located at the Bexley City Police Department. After conducting further research our team came up with additional recommendations that complement this original request. These recommendations are based on data collected from the city, community members' input, and existing benchmark programs. The first recommendation lays out a plan for a physical drop-off site, as well as end markets for each material collected. The next recommendation involves Terracycle, a company that allows cities to recycle alternative materials and have them shipped back to their state-of-the- art recycling center. The final recommendation is a mobile application (app) where residents can easily research local facilities/end markets as well as connect to one another to promote reuse. Overall, these recommendations serve as a starting point for the City of Bexley and invite further data and input to be successful.

5.1 Curbside Drop-off Site

The initial request from the City of Bexley was a "curbside drop-off site." Located at the Bexley City Police Department, this site will act as a communal 'one-stop-drop" alternative materials recycling spot. This location was chosen because it is in a central part of town that is very well known to the residents. It is also in close proximity to all of the city's residences for their own convenience. The idea is that large metal or recycled wood bins would be located on the curb where residents will pull up and dispose of their alternative materials recyclables. In order to keep the program sustainable and manageable for the city, we had to narrow down the materials that would be accepted at this drop-off site. As noted above, the materials that we suggest including are paint cans, batteries, No.5 plastics, clothing, and Styrofoam. In the

survey mentioned above, it was made clear that people wanted a "local" spot that required little to no driving outside city limits.

The layout of this drop off point involves a simple concept. There will be a row of bins within a designated enclosure. Each bin will be dedicated to collect its own specific material. From there, each material will be taken to its own respective end market. The enclosure itself doesn't have to look like a bare parking lot with a bunch of dumpsters. The new bins can be nicely lined up with bushes and flowers around the enclosure. Each bin will be placed on concrete pads to allow cars to easily pull up and discard their recyclables in whichever bin is needed. Signage, lighting, and street markings will need to be installed so that people will know where to go to pull up. The program could be named "Curbcycle." There are several limitations to keep in mind: batteries are considered hazardous waste, how often these materials will be taken to respective end-markets is unknown, the level of contamination in the drop-off bins may vary, monitoring will be needed, and the quantity of materials remains to be seen. Most of these limitations can be better researched once the project is underway.

5.2 Terracycle

Our second recommendation provides a way for the City of Bexley to incorporate alternative material recycling into local businesses, schools, and individual homes. Terracycle is a company located in Trenton, New Jersey, that specializes in recycling "hard-to-recycle" waste. For this project we refer to that waste as alternative materials. Terracycle's "Zero Waste Box" allows residents to recycle almost any type of alternative material (*Figure 5.2.1 Terracycle Zero Waste Boxes*). These boxes can be located inside local businesses and schools in order to increase access to recycling and potentially add foot-traffic through businesses. According to Terracycle's website, the City of Bexley would fill out the necessary

forms to request a public drop-off location, then Terracycle would tailor a program to meet the needs of Bexley residents. This company has also created a free program that works with brands to incorporate closed-loop solutions. For example, instead of grinding or melting down recycled waste into pellets and creating new products, Terracycle has created packaging that can be sold back to companies to use for shipments. Terracycle also offers a free tool on their website that connects people to existing local recycling drop-off locations (*Figure 5.2.2 Terracycle End-Market Tool*). This tool is not 100% accurate, therefore our recommendation below of an app created by the city will be much more beneficial to community members. There are several limitations and unknown variables to Terracycle including transportation logistics, emissions outputs, and costs. Overall, Terracycle appears to be the most comprehensive alternative materials recycling program, but the EEDS Capstone team was unable to communicate with Terracycle for more precise detail.

Figure 5.2.1 Terracycle Zero Waste Boxes

5.3 Mobile App

The third recommendation to the City of Bexley is to implement a mobile application (app), encompassing connectivity, education, and accessibility. This app will connect

residents to currently available local alternative material recycling options. One of the many features of the app will be a listing section where residents can post an alternative material they would like to recycle: other members can see this post and either “pick-up,” “buy,” or “find end-markets” for these materials. For example, if one resident has an abundance of leftover paint or paint cans, they can list this item on the app. Another resident with a purpose for these paints and/or paint cans may see this listing and connect with the original poster to set up a time to exchange the leftover paint and/or paint cans. This app promotes reuse before recycling.

The most important aspect of alternative materials is finding an end market, as many municipal waste management companies, including Rumpke, do not deal with such materials. This app, if adapted and designed by The City of Bexley (Green Bexley) will educate residents on what can be recycled, where certain materials are accepted, and provide information on how those facilities are disposing of the waste. Most importantly we hope this app will be easy to navigate and user friendly as to promote proper recycling habits.

There is a pre-existing program created through Terracycle that allows you to search your zip-code and find drop-off sites for alternative materials. An example of this program, related to the City of Bexley, is shown by *Figure 5.3.1 Mobile Application to locate Terracycle boxes,* shown below. This could be a great tool for residents to utilize as well as act as an example Bexley could use to design their own mobile application. By keeping drop-off and disposal local, transportation and logistics costs are somewhat externalized and taken away from the city. This can be a good aspect of externalizing end-markets but requires strong partnerships with programs like Terracycle.

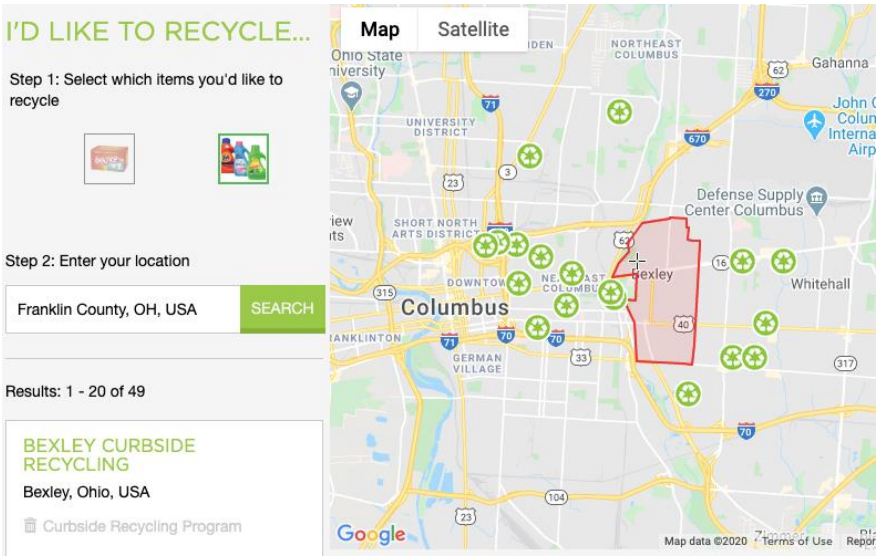

Figure 5.3.1 Mobile Application to locate Terracycle boxes

6.0 Conclusion

The survey results are a key indicator that Bexley residents are actively seeking a system to recycle alternative materials. Bexley community members are passionate about sustainability and Green Bexley helps initiate those goals. By completing this report, we hope to have helped the City of Bexley assemble solutions to create a comprehensive alternative material recycling program. Our recommendations are based on research compiled over the last few months, community input, and communications with Elizabeth Ellman (Green Bexley, Chair). In order to accomplish this project within our limited timeline we narrowed down the list of alternative materials that we would study to tattered clothing, batteries, paint cans, Styrofoam, and No.5 plastics. Our EEDS Capstone team was able to incorporate the initial goal of a curbside drop-off site, but we feel that in order to make a program that is sustainable and manageable there must be a combination of all three of our recommendations. Our raw data files are available upon request to provide additional information that might help inform the implementation of an alternative materials recycling program in Bexley and elsewhere. This report serves as a starting point for an alternative materials recycling program within the City of Bexley.

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8.0 Appendix

Data Sources

Dataset #1: One Minute Recycling Survey (Responses).xlsx

Source: Responses from residents in the Bexley, Ohio

Description: Excel file containing results of conducted survey. This data was used to identify needs and willingness of Bexley residents when it comes to recycling, specifically alternative materials. Surveying was sent out electronically through various outlets, including the Bexley Buzz (social media), Bexley Blast (email newsletter), and ESAC/Green Bexley (email chain) via Elizabeth Ellman. The data was used to create *Figure 4.3.1 Survey Question #1*, *Figure 4.3.2 Survey Question #3*, and *Figure 4.3.3 Survey Question #5*.

Dataset #2: One Minute Bexley Recycling Survey – responses.pdf

Source: Graphics generated using One Minute Recycling Survey (Responses).xlsx

Description: PDF file containing graphics displaying results of conducted survey. Select graphics can be found within the report in *Figure 4.3.1 Survey Question #1*, *Figure 4.3.2 Survey Question #3*, and *Figure 4.3.3 Survey Question #5*.